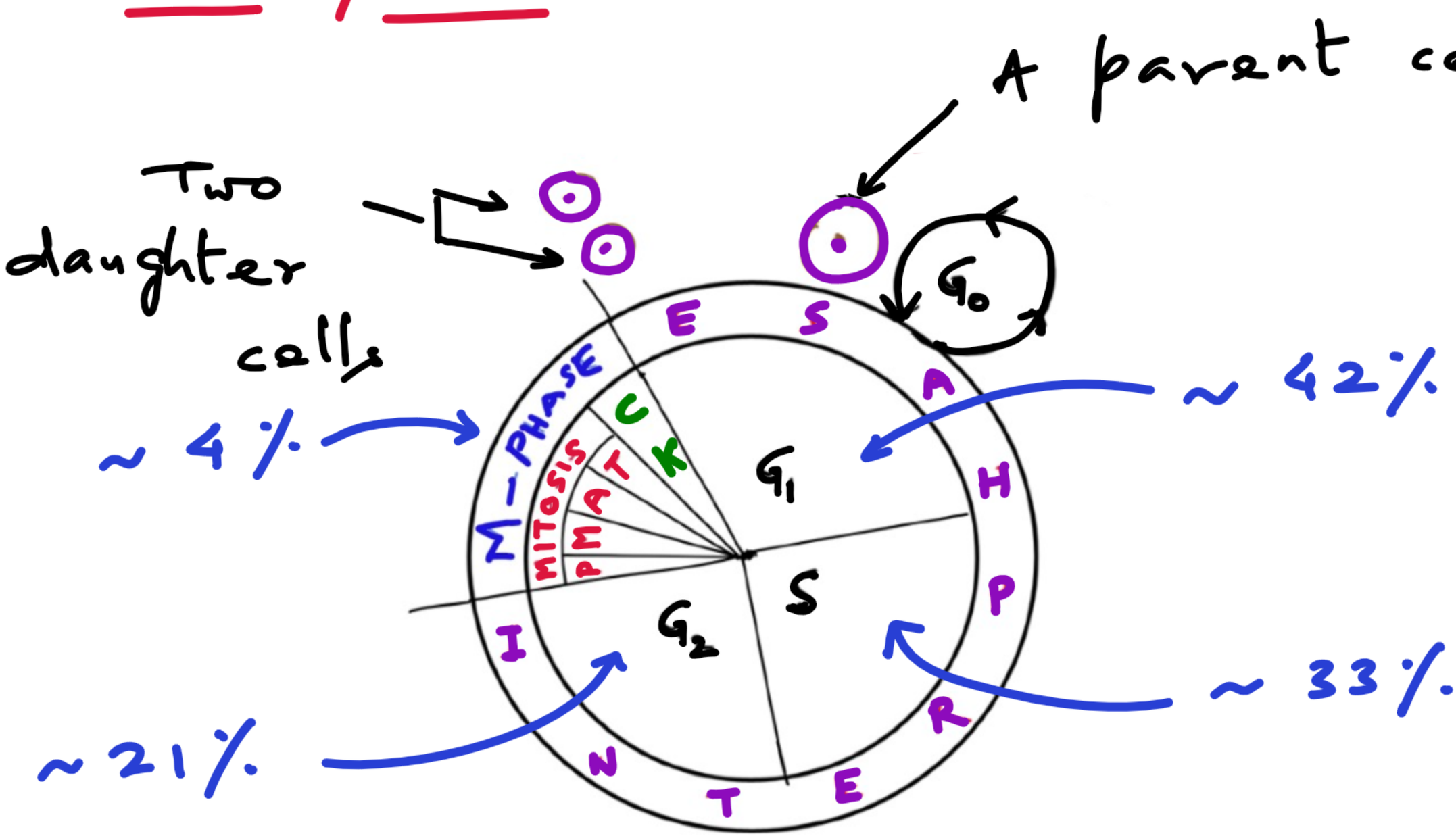
Cell Cycle



Cell Cycle = Interphase + M-phase

→ The duration of cell cycle vary from organism to organism and from one cell type to the other.

(Eg) Yeast cell cycle take 90 mins.

Human cell cycle takes 24 hrs.

Interphase

→ Though also called 'resting phase' (because cell is not dividing) but during this phase all the preparations for cell division is going on.

Interphase is divided into 3 phases :

① G_1-phase (= Gap 1 phase)

→ First growth phase or post mitotic gap phase

→ Cell is metabolically active.

→ RNA + protein synthesis occurs

→ Cell size increases

→ Cell organelles also increase in number (except → centriole, mitochondria & chloroplast).

→ Nucleotides, ATP, DNA polymerases are synthesised.

→ It is the most variable phase

→ Important check points are present which decides whether the cell will proceed cell cycle or not.

→ # G_0 - phase (= Quiescent stage)

∴

- It is the permant <u>or</u> temporary exit from G_1 phase

- Cells at this stage remains metabolically active but no longer proliferate unless required.

Examples of permanent G_0 phase:

(i) In animals - Neuron & heart cells

(ii) In plants - Cells which have undergone permanent differentiation like epidermis and endodermis cells

Examples of temporary G_0-phase:

(i) In animals - Liver cells & Kidenay cells

(ii) In plants - Cells undergoing dedifferentiation.

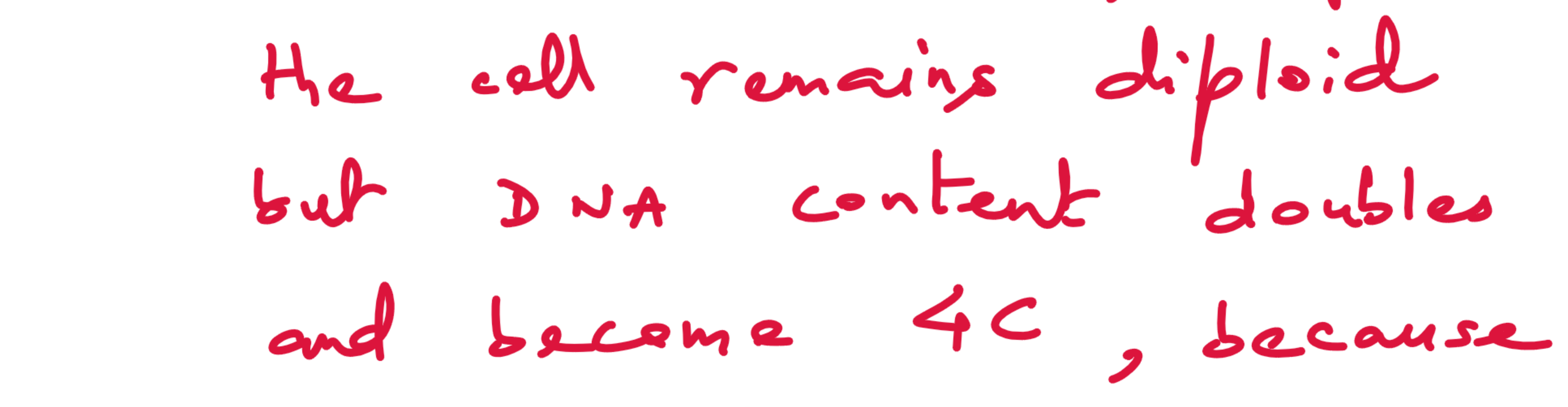
(ii) S-phase (= synthetic phase).

→ Histone protein is synthesised

→ DNA replication occurs

⊛ For a diploid (2n) cell, in G_1-phase DNA content is taken as 2C.

At the end of S-phase, the cell remains diploid but DNA content doubles and become 4C, because of replication.



→ In animal cells, centriole replicate / duplicate. At the end of S-phase, two pairs of centrioles are formed.

(iii) G_2 - phase (= Gap 2 phase)

→ Second growth phase or pre-mitotic gap phase

→ Cell continues to grow and cytoplasmic increase is maximum.

→ RNA + protein synthesis continues.

→ Mitochondria and chloroplast increase in number by fission

→ α and β tubulin proteins are synthesized.

M - phase

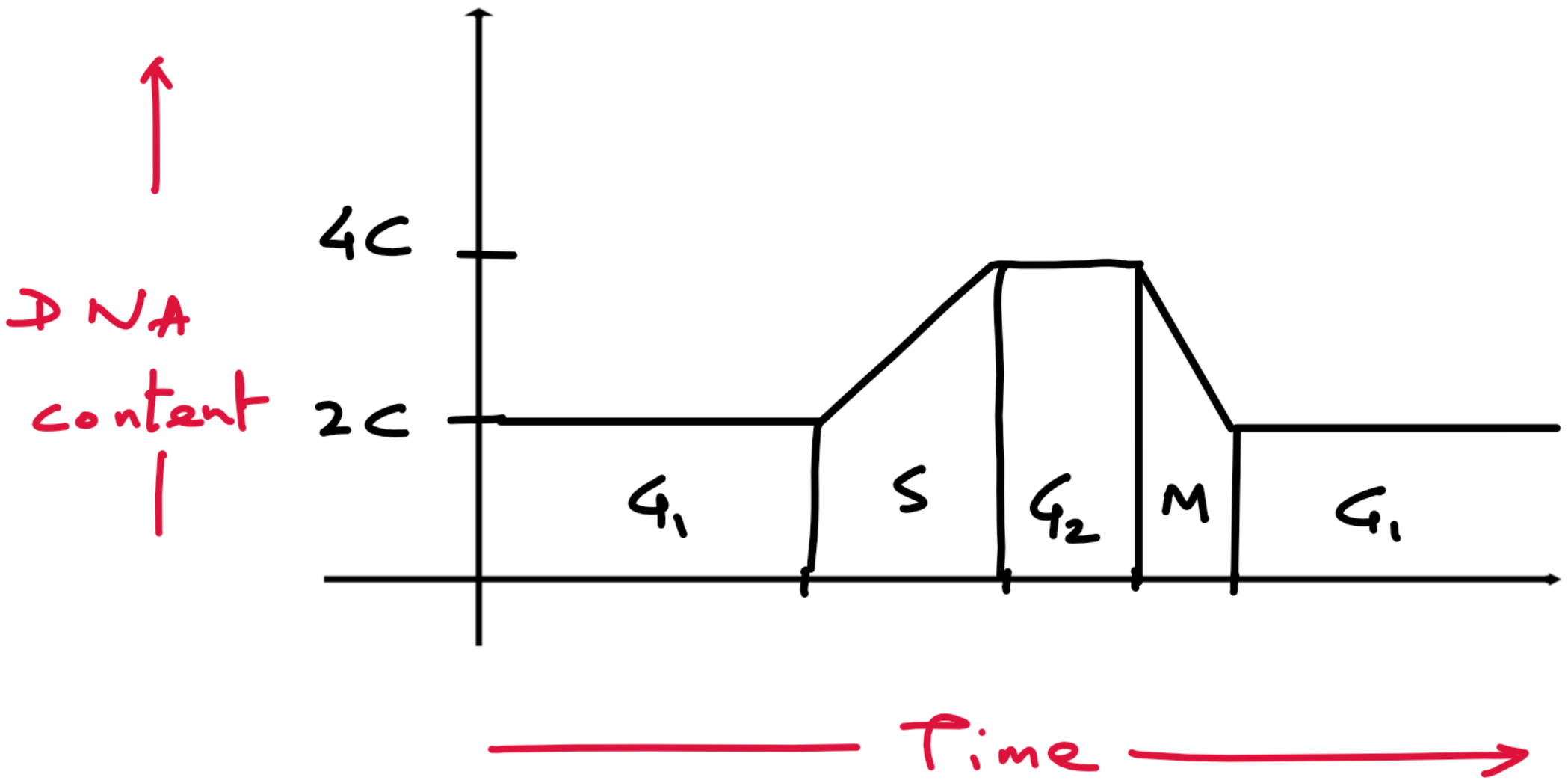
→ Mitosis + Cytokinesis

→ M - phase (w.r.t mitosis)

represents the most dramatic period of cell cycle.

→ M-phase takes ONLY 4-5% of total time of cell cycle.

NOTE: Cell cycle showing changes in DNA content



Cell Cycle Regulation

→ It is done with the help of Cyclin Dependent Kinase (CDK).

→ CDK for its activity depends on cyclin protein.

MITOSIS

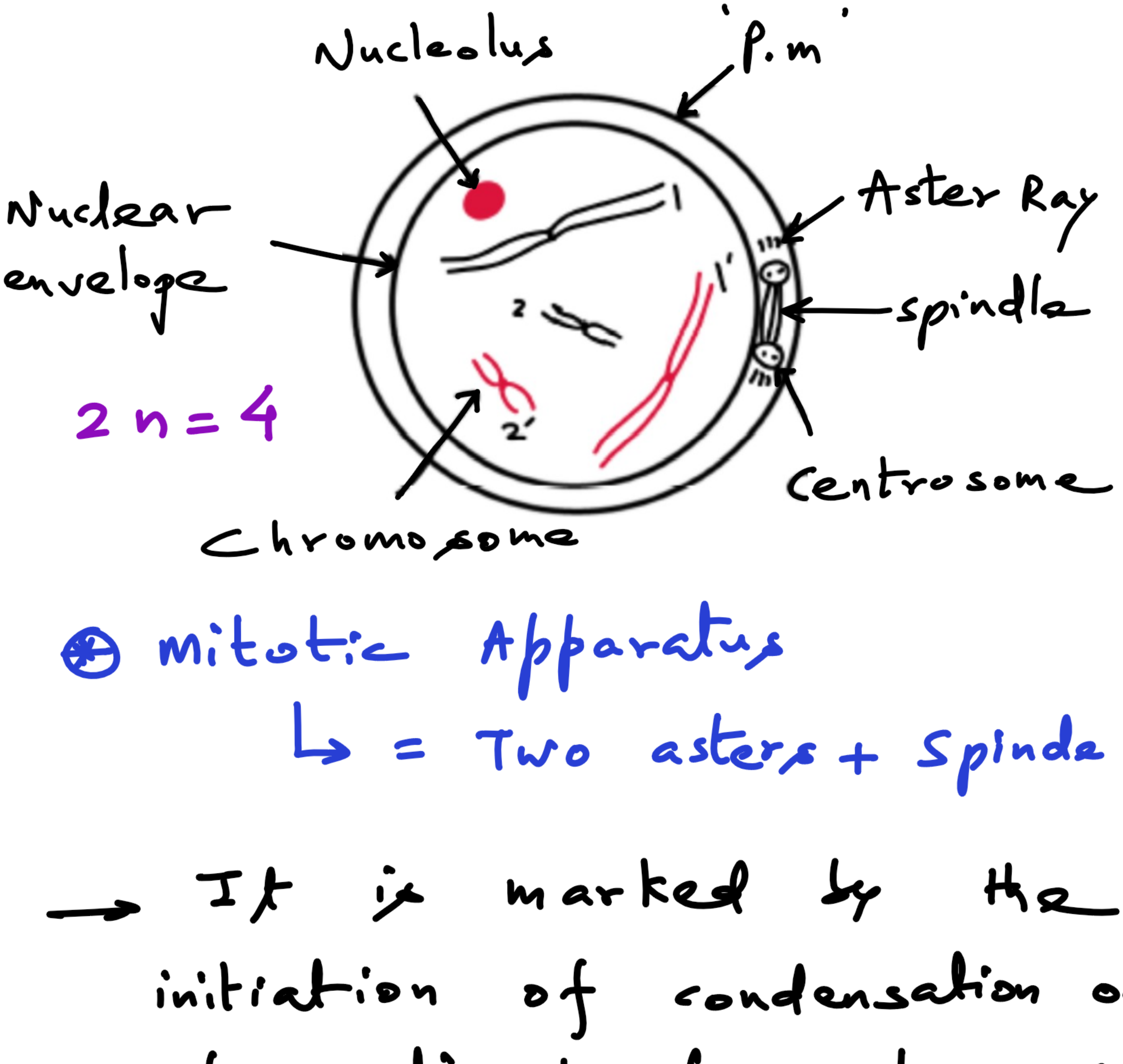
→ It is called equational cell division because the no. of chromosomes present in the daughter cells is same as the parent cell.

→ The cell which undergoes mitosis is called a mitocyte

which may be haploid (n) OR diploid (2n).

Mitosis has 4 phases:

① PROPHASE



* mitotic Apparatus
  ↳ = Two asters + Spinde fibres

→ It is marked by the initiation of condensation of chromatin to form chromosome.

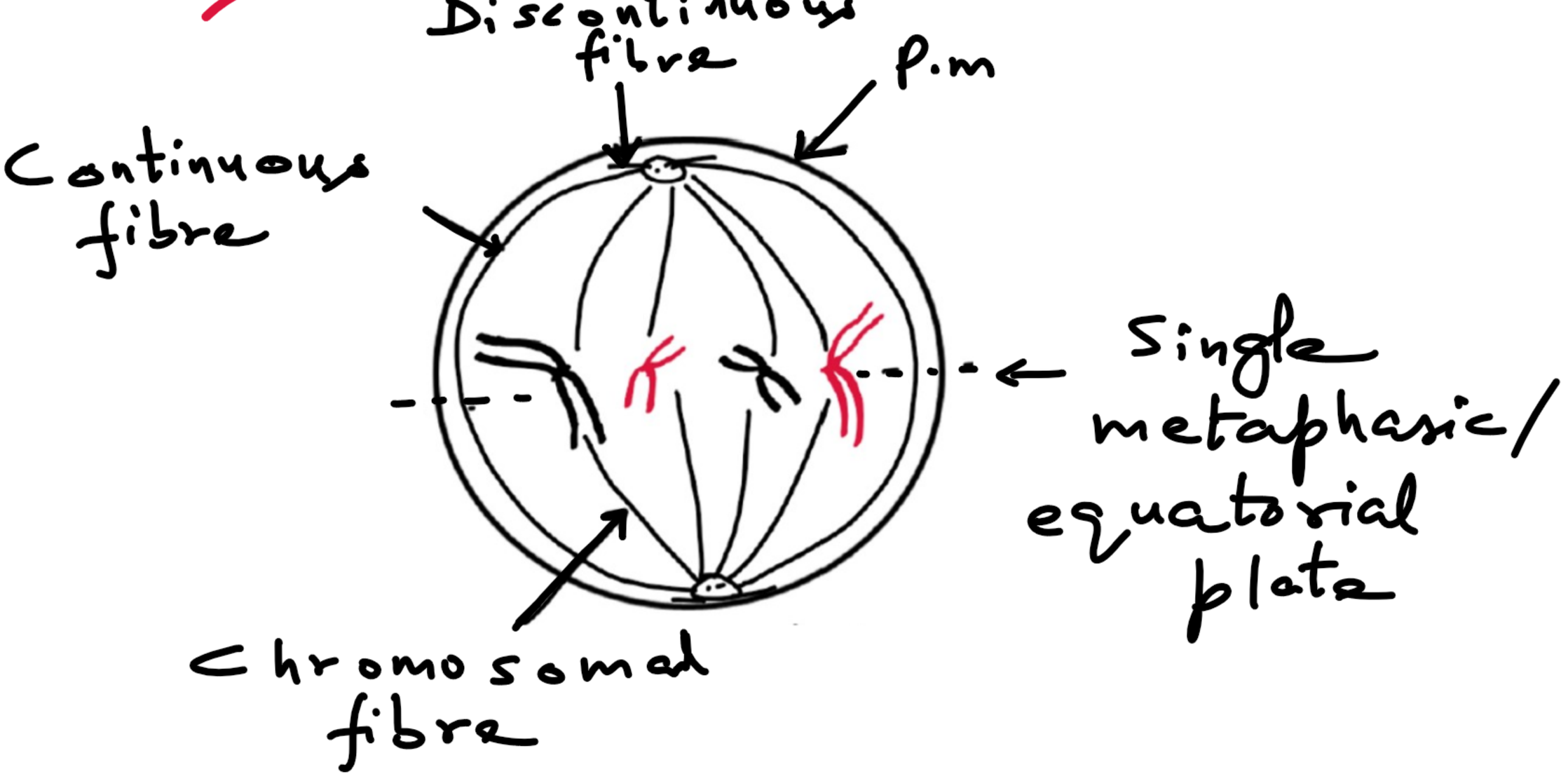
→ The chromosomal material becomes untangled during the

chromatin condensation.

→ Centrosomes move towards the opposite poles in animal cells. Each centrosome radiates out fine microtubules called aster ray.

→ Cells at the end of prophase when viewed under microscope, do not show Golgi, E.R, nuclear envelope and nucleolus.

(II) METAPHASE



→ The complete disintegration of the nuclear envelope marks the start of metaphase.

⊛ Nucleoplasm and Cytoplasm get mixed.

→ Chromosome appears thickest. So, chromosome morphology and karyotype can be best studied in this phase

→ Each chromosome posses two chromatids

→ All the chromosomes come to lie in the equatorial plate which is called congression.

→ Spindle fibres attach to the kinetochores of chromosome.